

$^9\text{Be}(\alpha, \text{n}), (\alpha, ^{12}\text{C})$  **2011Fr02, 2017Ke05**

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, J. E. Purcell and C. G. Sheu		NP A968, 71 (2017)	1-Jan-2017

- 1965Li09:  $^9\text{Be}(\alpha, \text{N})$  E=1.9-4.5 MeV, measured polarization ( $E, \theta$ ).
- 1966Mi12:  $^9\text{Be}(\alpha, \text{n}_0)$  E=5.0-12.0 MeV,  $^9\text{Be}(\alpha, \text{n}_1)$  E=4.3-12.0,  $^9\text{Be}(\alpha, \text{n}_2)$  E=6.0-10.1, measured  $\sigma(E, \theta=0^\circ)$ .
- 1967Ca02:  $^9\text{Be}(\alpha, \text{ny})$  E<5.3 MeV, measured  $E_\gamma$ .  $^{12}\text{C}$  deduced levels,  $T_{1/2}$ .
- 1968Da05:  $^9\text{Be}(\alpha, \text{N})$  E=0.34-0.68 MeV, measured  $\sigma(E, E_N, \theta)$ .
- 1968Le24:  $^9\text{Be}(\alpha, \text{N})$  E=1-6 MeV, measured  $\sigma(E, E_N)$ .
- 1969Kl09:  $^9\text{Be}(\alpha, \text{N})$  E=1.75, 1.96 MeV, measured  $\sigma(\theta)$ , Q, P( $\theta$ ).
- 1969No01:  $^9\text{Be}(\alpha, \text{N})$   $E_\alpha < 5.48$  MeV, measured  $\sigma(E_N)$ .
- 1970St16:  $^9\text{Be}(\alpha, \text{N})$  E=2.4-2.9 MeV, measured P(N) ( $E, \theta$ ).
- 1970Va23, 1973We03:  $^9\text{Be}(\alpha, \text{N})$  E=1.5-7.8 MeV, measured  $\sigma(E, E_N, \theta)$ .
- 1972De10:  $^9\text{Be}(\alpha, \text{N})$   $E_\alpha$  from Po-Be source, measured  $\sigma(E_N)$ ,  $\gamma$ n-delay.  $^{12}\text{C}$  level deduced neutron decay.
- 1972Ob01:  $^9\text{Be}(\alpha, \text{N})$  E=1.69-6.44 MeV, measured  $\sigma(E, \theta)$ .
- 1973De14:  $^9\text{Be}(\alpha, \text{N}_0), (\alpha, \text{N}_1)$  E=4.5-5.85 MeV, measured P( $E, E_N, \theta$ ).
- 1973Lo16:  $^9\text{Be}(\alpha, \text{N})$ , measured  $E_N$ , I $_N$ .
- 1973Ok06:  $^9\text{Be}(\alpha, \text{N})$  E=22.9 MeV, measured  $\sigma(E_N, \theta)$ , P( $E_N, \theta$ ).
- 1974Du12:  $^9\text{Be}(\alpha, \text{N})$  E=1.95-3.11 MeV, measured P $_n(\theta)$ .
- 1975Bu09:  $^9\text{Be}(\alpha, \text{N})$  E=23, 25 MeV, measured  $\sigma$ .
- 1976Ni01:  $^9\text{Be}(\alpha, \text{N})$  E=2.40-2.80 MeV, measured polarization P( $E, \theta$ ).
- 1977Li19:  $^9\text{Be}(\alpha, \text{N})$  E<7 MeV, analyzed  $\sigma(E)$ .
- 1978Hi06:  $^9\text{Be}(\alpha, \text{N}_0), (\alpha, \text{N}_1)$  E=6.4-6.5 MeV, measured  $\sigma(E, \theta)$ .
- 1978Le10:  $^9\text{Be}(\alpha, \text{N})$  E=100 MeV, measured  $E_N$ , neutron polarization.
- 1979Ba48:  $^9\text{Be}(\alpha, \text{N})$  E=3-7.5 MeV, measured  $\sigma$ .
- 1981Lo13:  $^9\text{Be}(\alpha, \text{N})$  E=12, 20, 24, 30 MeV, measured  $\sigma(E_N)$ , thick target yields.
- 1983La17:  $^9\text{Be}(\alpha, \text{ny})$  E=2.4 MeV, measured  $E_\gamma$ , I $_\gamma$ , thick target  $\gamma$  yields.
- 1986Ka24:  $^9\text{Be}(\alpha, \text{N})$  E=Am-Be source, measured  $E_\gamma$ , I $_\gamma$ .  $^{12}\text{C}$  level deduced absolute  $\gamma$ -emission rate.
- 1987Vu02:  $^9\text{Be}(\alpha, \text{N})$  E≤10 MeV, compiled  $\sigma(E)$ , neutron yields.
- 1989Cr07:  $^9\text{Be}(\alpha, \text{N})$  E=radioactive source, measured  $\gamma$  yield relative to neutron yield. Deduced neutron intensity calibrated  $^9\text{Be}(\alpha, \text{N})$  source utility In  $\gamma$ -yield measurements.
- 1990We10:  $^9\text{Be}(\alpha, \text{N})$  E=1.9-3.1 MeV, measured  $\sigma(\theta)$ , polarization.
- 1992Ki28:  $^9\text{Be}(\alpha, \text{ny})$  E=1.9-4.1 MeV, measured  $\sigma(\theta, N)$ ,  $\gamma$ -spectra, I $_\gamma(\theta)$ . Deduced ny-correlation function.
- 1993Bo31:  $^9\text{Be}(\alpha, \text{N})$  E=12.6 MeV, measured neutron spectra,  $\theta=25^\circ$ . Deduced target average areal density, homogeneity features.
- 1994Ha32:  $^9\text{Be}(\alpha, \text{N})$  E=480-740 keV, measured  $\sigma(E)$ . Deduced resonance  $\sigma$ ,  $\Gamma$ , Tokamak materials study relevance.
- 1994Wr01:  $^9\text{Be}(\alpha, \text{N})$   $E_{\text{c.m.}} = 0.16$ -1.87 MeV, measured  $\sigma(E)$ , thick target yield.
- 1996Ku07:  $^9\text{Be}(\alpha, \text{N})$  E=0.5-3.5 MeV, measured yield,  $\sigma(E)$ . Deduced astrophysical S-factor vs E, reaction rate.
- 2004Mo18:  $^9\text{Be}(\alpha, \text{N})$  E=spectrum, measured  $E_\gamma$ , ny-coin. Deduced  $\gamma$ -ray to neutron emission ratio for Am-Be source.
- 2007Ma58:  $^9\text{Be}(\alpha, \text{ny})$  E=2.27 MeV; measured yields.
- 2009Gi03, 2010Gi07:  $^9\text{Be}(\alpha, \text{ny})^{12}\text{C}$  E=1.9-4.5 MeV, analyzed experimental data. Deduced angular correlation parameters for  $\sigma(\theta)$ ,  $\sigma$ .
- 2011Gi05:  $^9\text{Be}(\alpha, \text{ny})$  E=0.3-7.9 MeV, measured reaction products. Deduced  $\sigma$ , reaction rate.
- 2011Fr02: XUNDL dataset compiled by TUNL, 2011.
- Measured  $^{12}\text{C}(\alpha, 3\alpha)^4\text{He}$  and  $^9\text{Be}(\alpha, 3\alpha)\text{n}$   $E_\alpha = 22$ -30 MeV in search of  $^{12}\text{C}$  resonances above  $E_x = 7$  MeV that could have structures related to the Hoyle state.
- $\alpha$ -particles impinged on a  $1 \text{ mg/cm}^2$   $^9\text{Be}$  target detected coincident  $3\alpha$  events in  $5 \text{ cm} \times 5 \text{ cm}$  array of position sensitive Si strip detectors covering  $-69^\circ \leq \theta \leq 71^\circ$ .
- Analyzed  $3\alpha$  kinematics to determine the  $^{12}\text{C}$  excitation energies. The analysis was further constrained to separately consider both, events populating natural parity states involving  $^{12}\text{C}^* \rightarrow {}^8\text{Be}_{\text{g.s.}}(J^\pi = 0^+)+\alpha$  and events that excluded  $^{12}\text{C}^* \rightarrow {}^8\text{Be}_{\text{g.s.}}+\alpha$ . The excitation spectra in both cases are compared. A state consistent with  $E_x = 13.3$  MeV 2 and  $\Gamma = 1.7$  MeV 2 was found.
- Analysis of the angular correlations from the  $^{12}\text{C}(\alpha, 3\alpha)$  reaction support  $J^\pi = 4^+$  for the 13.3 MeV state.
- Target  $J^\pi = 3/2^-$ .

$^9\text{Be}(\alpha, \text{n}), (\alpha, ^{12}\text{C})$     2011Fr02, 2017Ke05 (continued) $^{12}\text{C}$  Levels

E(level)	J $^\pi$	T <sub>1/2</sub> or $\Gamma$	Comments
0 $4.4 \times 10^3$			
$7.65 \times 10^3$		$35 \text{ fs } 4$	$\Gamma_y = 11.5 \times 10^{-3} \text{ eV}$ +50–32 T <sub>1/2</sub> : From $\tau_m = 50 \text{ fs } 6$ (see unpublished reference in 1975Aj02). See also $\tau_m = 57 \text{ fs}$ +23–17 (1966Wa10) and T <sub>1/2</sub> ≤33 fs 7 (1967Ca02).
$9.64 \times 10^3$ <sup>†</sup>			$\Gamma_\pi/\Gamma = (6.9 \pm 2.1) \times 10^{-6}$ (1959Al97, 1960Aj04, 1960Al04, 1961Ga03).
$10.1 \times 10^3$ ?			
$10.84 \times 10^3$ <sup>†</sup>			
$11.83 \times 10^3$			
$12.71 \times 10^3$			
$13.3 \times 10^3$ <sup>†</sup>	2    ( $4^+$ )	1.7 MeV 2	J $^\pi$ : Analysis of the 3 $\alpha$ angular correlations is consistent with J $^\pi$ = $4^+$ . It is suggested that the E <sub>x</sub> =7.65 MeV( $0^+$ ), 13.3 MeV( $4^+$ ) and an unobserved J $^\pi$ = $2^+$ state near 9.4 MeV form a rotational band (2011Fr02).
$14.08 \times 10^3$ <sup>†</sup> $\approx 17 \times 10^3$			

<sup>†</sup> From natural parity states involving  $^{12}\text{C}^* \rightarrow {}^8\text{Be}_{\text{g.s.}}(J^\pi=0^+) + {}^4\text{He}$ .

 $\gamma(^{12}\text{C})$ 

E $_\gamma$	E <sub>i</sub> (level)	E <sub>f</sub>	Mult.
4400	$4.4 \times 10^3$	0	E2

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